UNIVERSITI SAINS MALAYSIA

UNIVERSITY RESEARCH GRANT FINAL REPORT
Geran Penyelidikan Universiti Laporan Akhir

Please email a copy of this report to rcmo@usm.my
Sila emel salinan laporan ini ke rcmo@usm.my

A.	**PARTICULARS OF RESEARCH** / *MAKLUMAT PENYELIDIKAN:*
(i)	**Title of Research:** *Tajuk Penyelidikan:* A Research On Sustainable Growth: Exploring The Aspects of Income Inequality, Environmental Quality and Effective Policy Regime
(ii)	**Account Number:** *Nombor Akaun: 1001/PMATHS/811199*
B.	**PERSONAL PARTICULARS OF RESEARCHER** / *MAKLUMAT PENYELIDIK:*
(i)	**Name of Research Leader:** *Nama Ketua Penyelidik:* DR. SEK SIOK KUN
	Name of Co-Researcher: *Nama Penyelidik Bersama:* DR. MOHD TAHIR BIN ISMAIL PROF. DR. KUNIO SHIMIZU
(ii)	**School/Institute/Centre/Unit:** *Pusat Pengajian /Institut/Pusat/Unit:* MATHEMATICAL SCIENCES
D.	**Duration of this research:** *Tempoh masa penyelidikan ini:* ***Duration :** .....2 YEARS 9 MONTHS..... *Tempoh :* **From** : .....1 DECEMBER. 2011__ **To** : ....31 AUG.....2014__ *Dari:* *Ke :*

E. **ABSTRACT OF RESEARCH**

(An abstract of between 100 and 200 words must be prepared in **Bahasa Malaysia and in English**. This abstract will be included in the Annual Report of the Research and Innovation Section at a later date as a means of presenting the project findings of the researcher/s to the University and the community at large)

Abstrak Penyelidikan

(Perlu disediakan di antara 100 - 200 perkataan di dalam **Bahasa Malaysia dan juga Bahasa Inggeris**.
Abstrak ini akan dimuatkan dalam Laporan Tahunan Bahagian Penyelidikan & Inovasi sebagai satu cara untuk menyampaikan dapatan projek tuan/puan kepada pihak Universiti & masyarakat luar).

Abstract

The (trade-off) relationships between economic growth and other macroeconomic variables (income inequality, inflation and environmental quality) are explained by theoretical models. In this project, we empirical investigate how true these theoretical relationships hold for different groups of economies. In particular we investigate if these relationships are affected by the adoption of different monetary policy regimes. In addition, we also seek to reveal if there exist a two-way inter-determinant relationship between economic growth and the three macroeconomic variables. Our results reveal that the relationships between economic growth and these three variables vary across groups of countries and theoretical models may not hold always. Monetary policy and exchange rate flexibility have significant impact on determining the trade-off between inflation and growth.

Abstrak

Keterbalikkan hubungan antara pertumbuhan ekonomi dengan pembolehubah makroekonomi (ketidakrataan pendapatan, inflasi dan kualiti persekitaran) dijelaskan oleh model teori. Dalam projek ini, kami mengadakan penyelidikan empirikal sejauh manakah hubungan teori ini benar dalam beberapa kumpulan negara. Secara khususnya, kami mengkaji jika hubungan tersebut adalah dipengaruhi oleh implimentasi policy kewangan yang berlainan. Tambahan lagi, kami juga ingin mencari sama ada terdapat hubungan dua-hala saling pengaruh antara pendapatan ekonomi dan tiga pembolehubah tersebut. Keputusan kami menunjukkan bahawa hubungan antara pendapatan ekonomi dan tiga pembolehubah ini berubah mengikut kumpulan negara dan hubungan yang dijelaskan melalui teori tidak selalu benar. Polisi kewangan dan fleksibiliti kadar pertukaran mempunyai impak signifikan dalam menentukan keterbalikkan hubungan antara inflasi dan pendapatan.

F. **SUMMARY OF RESEARCH FINDINGS**
Ringkasan dapatan Projek Penyelidikan

Economic growth versus environmental quality

Our results (both panel and non-panel) reveal no or low interaction between environmental quality (proxy by CO_2 emissions) and income (proxy by GDP). The control variables have different impacts on growth and environmental degradation across economies. Trade and inflation have small or non significance impact on the two variables across economies. FDI can have negative effect on environmental quality in middle and low income economies. Population density and labour participation rate can have negative effect on emissions of carbon dioxide in low and middle income economies respectively.

Previous studies show that the environmental quality and economic growth can be represented by the inverted U curve called Environmental Kuznets Curve (EKC). In this study, we conduct empirical analyses on detecting the existence of EKC using the five common pollutants emissions (i.e. CO_2, SO_2, BOD, SPM_{10}, and GHG) as proxy for environmental quality. The data spanning from year 1961 to 2009 and cover 40 countries. We seek to investigate if the EKC hypothesis holds in two groups of economies, i.e. developed versus developing economies. Applying panel data approach, our results show that the EKC does not hold in all countries. We also detect the existence of U shape and increasing trend in other cases. The results reveal that CO_2 and SPM_{10} are good data to proxy for environmental pollutant and they can be explained well by GDP. Also, it is observed that the developed countries have higher turning points than the developing countries. Higher economic growth may lead to different impacts on environmental quality in different economies.

Economic growth versus income inequality

We conduct empirical analyses on the two-way relationship between income inequality and growth in three groups of income levels, i.e. lower middle, upper middle and high income countries. The data is collected for 31 countries, ranging from 1990 to 2011. Besides, four variables are tested as determinants of growth and income inequality. Applying a panel data approach, our results detect only one-way relationship, i.e. growth influences income inequality. There is no significance effect from income inequality on growth across three groups of countries. Our results also reveal that enrollments of primary education, price level of investment and trade openness have no significance impact on income inequality. These factors have impacts on growth but the impacts vary across countries.

Trade-off between inflation-growth

In this study, we seek to investigate the short-run and long-run relationship between inflation and growth in 3 groups of countries: high income, low income and middle income groups using the Auto Regression Distributed Lag models. The MG (Mean Group) and PMG (Pooled Mean Group) estimations are applied in this analysis. The Hausman Test is conducted to decide between the MG and PMG estimators. The panel data take the period of 1960- 2012. As the result, MG estimator is preferred by all the 3 groups of countries. Comparing the results, we observe significance short run and long-run impacts of inflation on output growth. The long-run impact is relatively larger than the short run impact. Our results detect long-run trade-off between inflation and growth in all groups of countries, i.e. lower inflation leads to the disinflation cost of lower growth. The long-run trade-off is the largest in middle income countries, followed by high income countries and the lowest in low income countries. Our results also show that depreciation of exchange rate will significantly lead to higher growth rate in all groups of countries.

The role of monetary policy regime

In another set of analysis, we seek to investigate how the monetary policy regime/ exchange rate flexibility can influence the relationship between inflation-growth. We construct three exchange rate flexibility indices. The countries are grouped based on their relative flexibility, i.e. high and low index. There are totally 55 countries included in this study. The data take the range from 1980 to 2012. The autoregressive distributed lag (ARDL) models are applied and the models are estimated using pooled mean group (PMG) approach. The information criterion of AIC and BIC are used to suggest the optimal lag length to be included in the models. The results reveal the trade-off relationship between inflation and growth (output gap) in the long run. However, the trade-off is very small with high index countries show larger trade-off. No trade-off is found in the short run. The exchange rate flexibility has significant impact on the growth/ output gap but the results do not suggest which group with larger impact. Further studies are needed to investigate the role of exchange rate on determining the inflation- growth from different aspects such as economic structures, the impacts of crisis etc.

G. COMPREHENSIVE TECHNICAL REPORT

Laporan Teknikal Lengkap

Applicants are required to prepare a comprehensive technical report explaining the project.
(This report must be attached separately)
Sila sediakan laporan teknikal lengkap yang menerangkan keseluruhan projek ini.
[Laporan ini mesti dikepilkan]

List the key words that reflect our research:

Senaraikan kata kunci yang mencerminkan penyelidikan anda:

English	Bahasa Malaysia
Environmental Kuznets Curve	Keluk persekitaran Kuznets
Inflation-output trade-off	Keterbalikan Inflasi-pendapatan
Income inequality	Ketidakrataan pendapatan

H. a) **Results/Benefits of this research**
Hasil Penyelidikan

No. *Bil:*	Category/Number: *Kategori/ Bilangan:*	Promised	Achieved
1.	**Research Publications (Specify target journals)** *Penerbitan Penyelidikan (Nyatakan sasaran jurnal)*	2	5 (journal)
2.	**Human Capital Development**		
	a. Ph. D Students		
	b. Masters Students	**2**	**6**
	c. Undergraduates (Final Year Project)		
	d. Research Officers		**1**
	e. Research Assisstants	**1**	**1**
	f. Other: Please specify (proceedings)		**3**
3.	**Patents** *Paten*		
4.	**Specific / Potential Applications** *Spesifik/Potensi aplikasin*		
5.	**Networking & Linkages** *Jaringan & Jalinan*		
6.	**Possible External Research Grants to be Acquired** *Jangkaan Geran Penyelidikan Luar Diperoleh*		

- Kindly provide copies/evidence for Category 1 to 6.

b) **Equipment used for this research.**
Peralatan yang telah digunakan dalam penyelidikan ini.

Items *Perkara*	Approved Equipment	Approved Requested Equipment	Location
Specialized Equipment Peralatan khusus	SOFTWARE UPDATE - STATA 13	APPLE TABLET PC	SCHOOL OF MATHEMATICAL SCIENCES, USM
Facility Kemudahan			
Infrastructure Infrastruktur			

- Please attach appendix if necessary.

I.	**BUDGET** / *BAJET*

Total Approved Budget : RM 67011.40
Total Additional Budget : RM -
Grand Total of Approved Budget : RM 67011.40

Yearly Budget Distributed

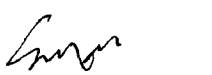
Year 1 : RM 32105.70
Year 2 : RM 34905.70
Year 3 : RM-

Additional Budget Approved

Year 1 : RM-
Year 2 : RM-
Year 3 : RM-

Total Expenditure : RM 67011.40
Balance : RM 0

- **Please attach final account statement from Treasury**



25/8/14

Signature of Researcher
Tandatangan Penyelidik

Date
Tarikh

H.	**COMMENTS OF PTJ'S RESEARCH COMMITTEE** *KOMEN JAWATANKUASA PENYELIDIKAN PERINGKAT PTJ*

General Comments:
Ulasan Umum:

Objektif dan hasil penyelidikan tercapai.

PROF. MADYA DR. ONG HONG CHOON
TIMBALAN DEKAN (PENYELIDIKAN)
PUSAT PENGAJIAN SAINS MATEMATIK
UNIVERSITI SAINS MALAYSIA
11800 PULAU PINANG
TEL.04-653 3284

.....

Signature and Stamp of Chairperson of PTJ's Evaluation Committee
Tandatangan dan Cop Pengerusi Jawatankuasa Penilaian PTJ

Date : 26/8/2014
Tarikh :.....

Signature and Stamp of Dean/ Director of PTJ
Tandatangan dan Cop Dekan/ Pengarah PTJ

Date : 26/8/14
Tarikh :.....

PROF. AHMAD IZANI MD ISMAIL
DEKAN
PUSAT PENGAJIAN SAINS MATEMATIK
UNIVERSITI SAINS MALAYSIA
11800 PULAU PINANG

PROF. MADYA DR. ONG HONG CHOON
TIMBALAN DEKAN (PENYELIDIKAN)
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UNIVERSITI SAINS MALAYSIA
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TEL: 04-653 2754

Purchase Requisition ▸ Purchase Order ▸ Suppliers ▸ Maintenance ▸ Financials ▸ Coda Info ▸ Reports ▸ Admin ▸

UserCode: SURIATI / USMPGLIVE / PMATHS **Program Code: Votebook9100** **Current Program : Votebook (Header)**

Current Date : 25/08/2014 3:56:51 PM **Version: 15.19, Last Updated at 06/02/2013** **DB: 13.02, 9/27/2010 VB: 13.01, 3/14/2011** **Switch Language : English / Malay**

Wildcard : eg. Like 100%, Like 10%1, Like %1

Element 1: 1001 Element 2: % Element 4: PMATHS

Element 5: 811199 Year: 2014

Detail	Excel	Budget Rule	Budget Control	Account Description	Budget Account Code	Roll over	Budget	Cash Received	Advanced	Commit	Actual	Available	Percentage
Detail	Excel	49	T	Projek Kumpulan Wang Uni Penyelidikan	1001.111.0.PMATHS.811199	39,353.71	0.00	0.00	0.00	0.00	0.00	39,353.71	0.00%
		49	T	SubTotal		39,353.71	0.00	0.00	0.00	0.00	0.00	39,353.71	0.00%
Detail	Excel	50	T	Projek Kumpulan Wang Uni Penyelidikan	1001.221.0.PMATHS.811199	4,344.22	0.00	0.00	0.00	659.80	11,594.05	-7,909.63	0.00%
Detail	Excel	50	T	Projek Kumpulan Wang Uni Penyelidikan	1001.222.0.PMATHS.811199	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
Detail	Excel	50	T	Projek Kumpulan Wang Uni Penyelidikan	1001.223.0.PMATHS.811199	682.20	0.00	0.00	0.00	0.00	0.00	682.20	0.00%
Detail	Excel	50	T	Projek Kumpulan Wang Uni Penyelidikan	1001.227.0.PMATHS.811199	-5,278.90	0.00	0.00	0.00	1,996.47	1,262.60	-8,537.97	0.00%
Detail	Excel	50	T	Projek Kumpulan Wang Uni Penyelidikan	1001.229.0.PMATHS.811199	-17,677.35	0.00	0.00	0.00	0.00	3,068.00	-20,745.35	0.00%
		50	T	SubTotal		-17,929.83	0.00	0.00	0.00	2,656.27	15,924.65	-36,510.75	0.00%
Detail	Excel	51	T	Projek Kumpulan Wang Uni Penyelidikan	1001.335.0.PMATHS.811199	-2,483.00	0.00	0.00	0.00	0.00	0.00	-2,483.00	0.00%
		51	T	SubTotal		-2,483.00	0.00	0.00	0.00	0.00	0.00	-2,483.00	0.00%
Detail	Excel	53	T	Projek Kumpulan Wang Uni Penyelidikan	1001.552.0.PMATHS.811199	-258.22	0.00	0.00	0.00	0.00	101.74	-359.96	0.00%
		53	T	SubTotal		-258.22	0.00	0.00	0.00	0.00	101.74	-359.96	0.00%
		9999		GrandTotal		18,682.66	0.00	0.00	0.00	2,656.27	16,026.39	0.00	0.00%

Technical Report for RU Grant

Prepared by:

Dr. Sek Siok Kun
School of Mathematical Sciences
Universiti Sains Malaysia

August 2014

- **Project Title:**

A Research on Sustainable Growth: Exploring the Aspects of Income Inequality, Environmental Quality and Effective Policy Regime

- **Project Leader:**

Dr. Sek Siok Kun

- **Project Team Members:**

Dr. Mohd. Tahir Ismail (USM)

Prof. Dr. Kunio Shimizu (Keio University, Japan)

- **Duration:**

33 months (1/12/2011 – 31/8/2014)

- **Account no.:**

1001/PMATHS/811199

1. Introduction

Economic growth is no more a new topic for researches. Yet this topic still remains interesting as it permits deeper analyses based on the dynamic of country specific factors and many more aspects (e.g. monetary policy, political factors etc.).

High growth does not always imply to positive outcome as perceived by many people. As explained by many theoretical models, economic growth (always proxy by GDP or gross domestic product) has trade-off relationship with some macroeconomic variables. The three main variables are inflation, income inequality and environmental quality. Trade-off means higher growth leads to the cost of negative outcome such as higher inflation, larger income gap and lower environmental quality or pollution which further leads to unsustainable growth. Therefore, high growth if lead to degradation quality of life and higher cost, may not lead to better economic condition. Hence, a stable and sustainable growth is preferred.

In this project, we seek to further examine if the theoretical relationships between economic growth versus inflation, income inequality and environmental quality hold for different groups of countries. In particular, we seek for possibility of two-ways relationships. We also intend to investigate if monetary policy regimes can influence the relationships. This project reveals deeper information on the dynamic relationships between growth and the macroeconomic variables and seeks possible solutions on reducing the cost of growth through monetary policy regimes or the role of monetary policy.

Problem statement

Based on the above discussion, we seek to answer the following questions:

i. Is there any trade-off relationship between economic growth versus inflation, income inequality and environmental quality?
ii. Is there any two-way relationship between economic growth versus inflation, income inequality and environmental quality?
iii. Does the adoption of different policy regime can influence the relationship mentioned above?

2. Objective

Tempting to answer the above questions, our objectives include:

i. To investigate if the trade-off relationship explained by theoretical models hold for different groups of countries.
ii. To examine if there possibility of two-way relationship between economic growth versus inflation, income inequality and environmental quality
iii. To reveal if the adoption of different policy regime can influence the relationship mentioned above

3. Methodology

We divide the analyses into several parts by applying different econometric techniques. Before conducting the analyses, we divide the countries into several groups low income, middle income and high

income groups; lower exchange rate flexibility versus higher exchange rate flexibility etc. The countries selected depend on the availability of data. The data are obtained from Datastream and IMF.

The technique applied include panel versus non-panel (time series) techniques. Among the methods/ techniques applied include panel versus non-panel VAR (vector autoregressive model), ARDL (autoregressive distributed lag models) models using MG (mean group) and PMG (pooled mean group) estimations, and static panel models. The results are compared across groups of countries, over different time frames and using different approaches.

For details about data and methodology, please refer to the publications listed.

4. Results

The results can be discussed by dividing them into four main parts as below:

Economic growth versus environmental quality

Our results (both panel and non-panel) reveal no or low interaction between environmental quality (proxy by CO2 emissions) and income (proxy by GDP). The control variables have different impacts on growth and environmental degradation across economies. Trade and inflation have small or non significance impact on the two variables across economies. FDI can have negative effect on environmental quality in middle and low income economies. Population density and labour participation rate can have negative effect on emissions of carbon dioxide in low and middle income economies respectively.

Previous studies show that the environmental quality and economic growth can be represented by the inverted U curve called Environmental Kuznets Curve (EKC). In this study, we conduct empirical analyses on detecting the existence of EKC using the five common pollutants emissions (i.e. CO2, SO2, BOD, SPM10, and GHG) as proxy for environmental quality. The data spanning from year 1961 to 2009 and cover 40 countries. We seek to investigate if the EKC hypothesis holds in two groups of economies, i.e. developed versus developing economies. Applying panel data approach, our results show that the EKC does not hold in all countries. We also detect the existence of U shape and increasing trend in other cases. The results reveal that CO2 and SPM10 are good data to proxy for environmental pollutant and they can be explained well by GDP. Also, it is observed that the developed countries have higher turning points than the developing countries. Higher economic growth may lead to different impacts on environmental quality in different economies.

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We conduct empirical analyses on the two-way relationship between income inequality and growth in three groups of income levels, i.e. lower middle, upper middle and high income countries. The data is collected for 31 countries, ranging from 1990 to 2011. Besides, four variables are tested as determinants of growth and income inequality. Applying a panel data approach, our results detect only one-way relationship, i.e. growth influences income inequality. There is no significance effect from income inequality on growth across three groups of countries. Our results also reveal that enrollments of primary education, price level of investment and trade openness have no significance impact on income inequality. These factors have impacts on growth but the impacts vary across countries.

Trade-off between inflation-growth

In this study, we seek to investigate the short-run and long-run relationship between inflation and growth in 3 groups of countries: high income, low income and middle income groups using the Auto Regression Distributed Lag models. The MG (Mean Group) and PMG (Pooled Mean Group) estimations are applied in this analysis. The Hausman Test is conducted to decide between the MG and PMG estimators. The panel data take the period of 1960- 2012. As the result, MG estimator is preferred by all the 3 groups of countries. Comparing the results, we observe significance short run and long-run impacts of inflation on output growth. The long-run impact is relatively larger than the short run impact. Our results detect long-run trade-off between inflation and growth in all groups of countries, i.e. lower inflation leads to the disinflation cost of lower growth. The long-run trade-off is the largest in middle income countries, followed by high income countries and the lowest in low income countries. Our results also show that depreciation of exchange rate will significantly lead to higher growth rate in all groups of countries.

The role of monetary policy regime

In another set of analysis, we seek to investigate how the monetary policy regime/ exchange rate flexibility can influence the relationship between inflation-growth. We construct three exchange rate flexibility indices. The countries are grouped based on their relative flexibility, i.e. high and low index. There are totally 55 countries included in this study. The data take the range from 1980 to 2012. The autoregressive distributed lag (ARDL) models are applied and the models are estimated using pooled mean group (PMG) approach. The information criterion of AIC and BIC are used to suggest the optimal lag length to be included in the models. The results reveal the trade-off relationship between inflation and growth (output gap) in the long run. However, the trade-off is very small with high index countries show larger trade-off. No trade-off is found in the short run. The exchange rate flexibility has significant impact on the growth/ output gap but the results do not suggest which group with larger impact. Further studies are needed to investigate the role of exchange rate on determining the inflation- growth from different aspects such as economic structures, the impacts of crisis etc.

5. Conclusion/ summary:

We found that theoretical explanation on the trade-off relationship between growth versus inflation, income inequality and environmental quality may not necessarily hold for all countries. Indeed, the relationship could be different due to economic income levels, exchange rate flexibility and economic structure which are country specific factors. The adoption of different exchange rate regime/ monetary policy can influence the relationship between growth and these three variables. However, we face the limitation of results due to data availability and difficulties in calculating exchange rate flexibility which is not directly observable. Further or extended research is necessary to reveal which policy regime can help to reduce the cost of growth and maximize the welfare of public.

OUTPUT

1. Supervision:

No.	Name	Graduated (year)	Program
1.	Ahmed R. M. Al Sayed	2012	Master in Statistics (mixed mode)
2.	Ong Suan Mei	2012	Master in Statistics (mixed mode)
3.	Sayed Kushairi Sayed Nordin	2012	Master in Statistics (mixed mode)
4.	Lim Cheah Ying	2012	Master (teaching mathematics – course work)
5.	Suraiza Samsudin	2013	Master (teaching mathematics – course work)
6.	Khoo Yi Theng	2014	Master in Statistics (mixed mode)

2. Publication:

Journal

1. Ahmad, R.M. Al Sayed & Sek, S. K. (2013). Environmental Kuznets curve: evidences from developed and developing economies. *Applied Mathematical Sciences*, 7(22): 1081-1092.
   - *Scopus*
2. Song, P. C., Sek, S.K & Har, W.M. (2013). Detecting the convergence clubs and catch up in growth. *Asian Economic and Financial Review*, 3(1): 1-15.
3. Ong, S.M. & Sek, S. K. (2013). Interactions between economic growth and environmental quality: panel and non-panel analyses. *Applied Mathematical Sciences*, 7(14): 687-700.
   - *Scopus*
4. Lim, C. Y. & Sek, S. K. (2014). Exploring the two-way relationship between income inequality and growth. *Journal of Advanced Management Science*, 2(1): 33-37.
5. Lim, Y.C. & Sek, S. K. (2014). An examination on the determinants of inflation. *Journal of Economics, Business and Management*. 3(7): 678-682.

Proceedings (ISI)

1. Song, P.C., Sek, S. K. & Har, W. M. (2012). Investigating the convergence of growth: a comparative study. International Proceedings of Economics Development and Research, 5-6 May, Kuala Lumpur.
2. Chu, J.F. & Sek, S. K. (2014). Investigating the relationship between inflation and growth: evidence from panel ARDL models. AIP conference proceedings of 21st National symposium on Mathematical Sciences, 6-8 November, Penang.
3. Khoo, Y.T. & Sek, S. K. (2014). Investigating the relationship between inflation and output gap: Does exchange rate regime matter? The International Borneo Business Conference, 21-22 August 2014, Kuching, Sarawak. – forthcoming

3. Research assistant:

Chu Jenq Fei (N17), 2013.

4. Research officer:
   Can Chung Yan

Proofs for Output

1) Supervision

2) Journal paper

3) Proceedings

UNIVERSITI SAINS MALAYSIA

INSTITUT PENGAJIAN SISWAZAH | INSTITUTE OF POSTGRADUATE STUDIES

Rujukan Kami : IPS11/MAH/046
Tarikh : 5 Oktober 2011

Universiti Sains Malaysia
11800 USM Pulau Pinang
www.ips.usm.my

Chu Jenq Fei
29, Taman Vienna, Lorong Seri Teruntum 12
25100, Kuantan
Pahang

Puan,

Tawaran Kemasukan Untuk Mengikuti Pengajian Siswazah di Universiti Sains Malaysia

Sukacita dimaklumkan bahawa Universiti telah meluluskan kemasukan puan sebagai calon pengajian siswazah. Butiran pencalonan puan adalah seperti berikut :-

Ijazah	:	Doktor Falsafah
Pusat Pengajian/ Pusat/ Unit	:	Pusat Pengajian Sains Matematik
Kampus	:	Kampus Induk, Pulau Pinang
Mod Pengajian	:	Penyelidikan
Bidang Pengajian	:	Kawalan Kualiti(MAH)
Tajuk Penyelidikan	:	Penyelidikan Hubungan di antara Inflasi dan Hasil pengeluaran berasaskan rangka kerja Pengoptimalan dan ekonometrik
Status Pencalonan	:	Penuh Masa
Tempoh Pencalonan	:	Min : 24 bulan/ 4 semester Mak : 60 bulan/ 10 semester
Tarikh Luput Tawaran	:	5 Oktober 2012
Syarat Tawaran	:	-
Penyelia Utama (PU)	:	Dr. Sek Siok Kun
Penyelia Bersama (PB1)	:	Dr. Mohd Tahir Bin Ismail
Penyelia Bersama (PB2)	:	-
Penyelia Bersama (PB3)	:	-
Penyelia Lapangan (PL)	:	-

Untuk maklumat lanjut tentang prosedur pendaftaran, sila rujuk Panduan Pendaftaran Pelajar yang disertakan.

Yang menjalankan tugas,

(AIZAT HISHAM AHMAD)
Penolong Pendaftar (Kemasukan)

s.k. Dekan, Pusat Pengajian Sains Matematik
(PU) Dr. Sek Siok Kun
(PB) Dr. Mohd Tahir Bin Ismail

Master Student Supervision.

SEMINAR - ISNIN, 9 JULAI 2012

DISERTASI - MST 566 - (SAMBILAN) - BILIK PERSIDANGAN

Bil.	Nama	Tajuk Disertasi	Penyelia	Pemeriksa Dalam
8.30 - 9.00 pg	Sayed Kushairi Sayed Nordin	Determinants Of Growth : A Panel Approach	Dr. Sek Siok Kun	Dr. Mohd. Tahir Ismail
9.00 - 9.30 pg	Tan Hian Pei	A Study Of The Run Length Distribution of Multivariate Synthetic T^2 Control Chart	Prof. Michael Khoo Boon Chong	Prof. Madya Ong Hong Choon
MESYUARAT MAJLIS PEMERIKSA				
11.30 - 12.00 tgh	Tee Wah Lian	Pengoptimuman Carta Kawalan T^2 Hotelling Pensempelan Ganda Dua	Prof. Michael Khoo Boon Chong	Prof. Madya Ong Hong Choon
12.00 - 12.30 tgh	Hamzah Abdul Hamid	Polytomous Logistic Regression	Pn. Suraiya Kassim	Dr. Norhashidah Awang

Master Student supervision

SEMINAR - JUMAAT, 6 JULAI 2012

DISERTASI - MST 566 - (SAMBILAN & PENUH MASA) - BILIK SEMINAR 107

Bil.	Nama	Tajuk Disertasi	Penyelia	Pemeriksa Dalam
9.00 - 9.30 pg	Nazliah Mohd Ali (S)	Testing Convergence In Inflation The Case Of Asian Economies	Dr. Sek Siok Kun	Dr. Fam Pei Shan
9.30 - 10.00 pg	Ahmed R. M. Al Sayed	Detecting the Environmental Kuznets Curve	Dr. Sek Siok Kun	Dr. Fam Pei Shan

VIVA - JUMAAT, 6 JULAI 2012

DISERTASI - MST 566 - (SAMBILAN & PENUH MASA) - BILIK SEMINAR 107

Bil.	Nama	Tajuk Disertasi	Penyelia	Pemeriksa Dalam
10.00 - 10.30 pg	Nazliah Mohd Ali (S)	Testing Convergence In Inflation The Case Of Asian Economies	Dr. Sek Siok Kun	Dr. Fam Pei Shan
10.30 - 11.00 pg	Ahmed R. M. Al Sayed	Detecting the Environmental Kuznets Curve	Dr. Sek Siok Kun	Dr. Fam Pei Shan

Master Student supervision

SEMINAR - SELASA, 10 JULAI 2012

DISERTASI - MST 566 - (PENUH MASA) - BILIK PERSIDANGAN

Masa	Nama	Tajuk Disertasi	Penyelia	Pemeriksa Dalam
8.30 - 9.00 pg	Lim Sok Li	A Comparison Of The Median Run Length (MRL) Performances Of The Max - DEWMA And SS - DEWMA Charts	Prof. Michael Khoo Boon Chong	Prof. Madya Ong Hong Choon
9.00 - 9.30 pg	Govindamal a/p Thangiah	A Comparison between the synthetic control chart and double sampling synthetic control chart	Prof. Michael Khoo Boon Chong	Prof. Madya Ong Hong Choon
9.30 - 10.00 pg	Teoh Kok Ban	Study on factors Affecting Mobile Networks Preferences in Penang	Prof. Madya Ong Hong Choon	Prof. Michael Khoo Boon Chong
10.00 - 10.30 pg	Alex Lim Jun Xiong	A Study on Memory Control Charts	Prof. Michael Khoo Boon Chong	Prof. Low Heng Chin
10.30 - 11.00 pg	Yap Ee Think	Stochastical Modelling Disease	Prof. Low Heng Chin	Prof. Madya Ong Hong Choon
11.00 - 11.30 pg	Ong Suan Mei	Inter - relationship between economic growth and environmental quality	Dr. Sek Siok Kun	Dr. Shamsul Rijal Muhammad Sabri

Master student supervision

UNIVERSITI SAINS MALAYSIA

PUSAT PENGAJIAN SAINS MATEMATIK
SCHOOL OF MATHEMATICAL SCIENCES

JADUAL SEMINAR DAN VIVA
Semester II, Sidang Akademik 2012/2013

Tarikh : Isnin, 29 Julai 2013

PROJEK - MGM 599 (Penuh Masa & Sambilan) - Bilik Persidangan

Masa	Calon	Tajuk Disertasi	Penyelia	Pemeriksa Dalam
SEMINAR				
9.00 pg	Lim Cheah Ying	Interactions of Human Capital Income Inequality and Growth	Dr. Sek Siok Kun	Dr. Fam Pei Shan
9.30 pg	Lim Yen Chee	Determinant of Inflation	Dr. Sek Siok Kun	Dr. Fam Pei Shan
10.00 pg	Suraiza Samsudin	Investigating The Impacts Of Inflation On Economic Growth	Dr. Sek Siok Kun	Dr. Shamsul Rijal Muhammad Sabri
10.30 pg	Hanisah Johor	Students Perceptions Towards Applications of Calculus in Engineering	Dr. Shamsul Rijal Muhammad Sabri	Dr. Sek Siok Kun
11.00 pg	Ng Cheow Hong	An Analysis Of Bowling Scores	Dr. Shamsul Rijal Muhammad Sabri	Dr. Hajar Sulaiman
VIVA				
11.30 pg	Lim Cheah Ying	Interactions of Human Capital Income Inequality and Growth	Dr. Sek Siok Kun	Dr. Fam Pei Shan
2.30 ptg	Lim Yen Chee	Determinant of Inflation	Dr. Sek Siok Kun	Dr. Fam Pei Shan
3.00 ptg	Suraiza Samsudin	Investigating The Impacts Of Inflation On Economic Growth	Dr. Sek Siok Kun	Dr. Shamsul Rijal Muhammad Sabri
3.30 ptg	Hanisah Johor	Students Perceptions Towards Applications of Calculus in Engineering	Dr. Shamsul Rijal Muhammad Sabri	Dr. Sek Siok Kun
4.00 ptg	Ng Cheow Hong	An Analysis Of Bowling Scores	Dr. Shamsul Rijal Muhammad Sabri	Dr. Hajar Sulaiman

Master student supervision

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Memorandum

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12 Jun 2014

Semua Calon Yang Berkenaan

SEMINAR DAN UJIAN VIVA-VOCE KURSUS MST 566/20 - DISERTASI
CALON SARJANA SAINS (Statistik) Mod Campuran – Penuh Masa & Sambilan
SEMESTER II, SIDANG AKADEMIK 2013/2014

Adalah dimaklumkan bahawa tuan/puan dikehendaki menyampaikan seminar dan menduduki ujian *viva-voce* pada hari Rabu, **9 Julai 2014** di Bilik Seminar 107, Pusat Pengajian Sains Matematik mengikut jadual tersebut :

Masa	Calon	Penyelia
SEMINAR		
9.00 pagi	Lim Jia Min	Dr.Adli Mustafa
9.30 pagi	Chien Yah Kiing	Dr.Mohd Tahir Ismail
10.00 pagi	Khoo Yi Theng	Dr.Sek Siok Kun
10.30 pagi	Nuraini Ismail	Dr.Mohd Tahir Ismail
11.00 pagi	Wong Sui Loong	Dr.Mohd Tahir Ismail
11.30 pagi	Mohd Hafiz Mohd Alham	Dr.Mohd Tahir Ismail
VIVA		
12.30tgh.	Lim Jia Min	Dr.Adli Mustafa
2.30 petang	Chien Yah Kiing	Dr.Mohd Tahir Ismail
3.00 petang	Khoo Yi Theng	Dr.Sek Siok Kun
3.30 petang	Nuraini Ismail	Dr.Mohd Tahir Ismail
4.00 petang	Wong Sui Loong	Dr.Mohd Tahir Ismail
4.30 petang	Mohd Hafiz Mohd Alham	Dr.Mohd Tahir Ismail

2. Untuk makluman tuan/puan, pihak pusat pengajian akan menyediakan 'overhead projector' dan *MS Powerpoint 2007* untuk persembahan seminar tersebut. Sila hadir sekurang-kurangnya 30 minit sebelum waktu seminar anda dimulakan. Masa yang diperuntukkan untuk persembahan ialah selama 25 minit iaitu 20 minit penyampaian dan 5 minit sesi soal jawab.

"BERKHIDMAT UNTUK NEGARA"
"Memastikan Kelestarian Hari Esok"

FATIMAH BANU JAHAN KHIR
Penolong Pendaftar Kanan

s.k Dekan

Timbalan Dekan (Penyelidikan)

Penyelia/Pemeriksa Dalam

40 tahun 1974-2014 pusat pengajian sains matematik
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Journal page

Applied Mathematical Sciences, Vol. 7, 2013, no. 22, 1081 - 1092
HIKARI Ltd, www.m-hikari.com

Environmental Kuznets Curve: Evidences from Developed and Developing Economies

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Abstract

Previous studies show that the environmental quality and economic growth can be represented by the inverted U curve called Environmental Kuznets Curve (EKC). In this study, we conduct empirical analyses on detecting the existence of EKC using the five common pollutants emissions (i.e. CO_2, SO_2, BOD, SPM_{10}, and GHG) as proxy for environmental quality. The data spanning from year 1961 to 2009 and cover 40 countries. We seek to investigate if the EKC hypothesis holds in two groups of economies, i.e. developed versus developing economies. Applying panel data approach, our results show that the EKC does not hold in all countries. We also detect the existence of U shape and increasing trend in other cases. The results reveal that CO_2 and SPM_{10} are good data to proxy for environmental pollutant and they can be explained well by GDP. Also, it is observed that the developed countries have higher turning points than the developing countries. Higher economic growth may lead to different impacts on environmental quality in different economies.

Journal paper

Asian Economic and Financial Review 3(1):1-15

Asian Economic and Financial Review

journal homepage: http://aessweb.com/journal-detail.php?id=5002

DETECTING THE CONVERGENCE CLUBS AND CATCH–UP IN GROWTH

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Siok Kun Sek

School of Mathematical Sciences, Universiti Sains Malaysia, Penang, Malaysia.

Wai Mun Har

Accountancy and Management, Universiti Tunku Abdul Rahman, Selangor, Malaysia.

ABSTRACT

We conduct empirical panel data analysis to detect the catching- up effect in growth and the possibility to form different convergence clubs in selected Europe and Asian economies. In particular, we seek to investigate if the selected countries are able to catch- up to the growth level of developed economy of the United Kingdom (U.K.). The control variables used to test for conditional convergence include inflation, trade, net inflow of foreign direct investment, total population and government consumption expenditure. Our results reveal that all economies except Turkey and India are able to catch- up with U.K. economy. The economies in both regions of Europe and Asia are able to form their convergence clubs.

Key Words: Catch–up effect, convergence, panel data analysis

INTRODUCTION

The research on economic growth remains interesting and continuing as it is the core objective of economic policy. Research scope for economic growth is broad. Many growth models are proposed to explain the dynamic of growth. Among these models include Solow Swan model, panel data model and neoclassical growth model. Economists are interested to identify the determinants to different growth levels across economies. The main determinants of growth include income per capita, trade openness, gross domestic product, schooling level, inflation and population. Besides previous studies also concern about the impact of growth on the environmental quality. For instance, Johansson (2001) conducted an empirical analysis on the impact of growth on air quality in the United States (U.S.). The author found that greater economic activity inevitably leads to degradation in air quality in U.S., i.e. economic growth has a negative impact on environmental

Journal paper

Applied Mathematical Sciences, Vol. 7, 2013, no. 14, 687 - 700

Interactions between Economic Growth and Environmental Quality: Panel and Non-Panel Analyses

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Abstract

We conduct empirical analyses on the relationship between environmental quality and income levels in three income groups, i.e. high, middle and low income economies for the periods of 1970 to 2008. Two approaches i.e. panel and non-panel data analyses are applied in examining the existence of two-way inter-relationship of environmental quality and income levels. Apart from this, the study also seeks to reveal the determinants that affect the inter-relationship of these two variables. The control variables to be tested include trade, foreign direct investment (FDI), population density, inflation, agricultural land and labour participation rate. Our results (both panel and non-panel) reveal no or low interaction between environmental quality (proxy by CO_2 emissions) and income (proxy by GDP). The control variables have different impacts on growth and environmental degradation across economies. Trade and inflation have small or non significance impact on the two variables across economies. FDI can have negative effect on environmental quality in middle and low income economies. Population density and labour participation rate can have negative effect on emissions of carbon dioxide in low and middle income economies respectively.

Keywords: Economic Growth; Environmental Quality; CO_2 Emissions; Panel data analysis

Journal paper

Exploring the Two-Way Relationship between Income Inequality and Growth

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Abstract—**We conduct empirical analyses on the two-way relationship between income inequality and growth in three groups of income levels, i.e. lower middle, upper middle and high income countries. The data is collected for 31 countries, ranging from 1990 to 2011. Besides, four variables are tested as determinants of growth and income inequality. Applying a panel data approach, our results detect only one-way relationship, i.e. growth influences income inequality. There is no significance effect from income inequality on growth across three groups of countries. Our results also reveal that enrollments of primary education, price level of investment and trade openness have no significance impact on income inequality. These factors have impacts on growth but the impacts vary across countries.**

Index Terms—**economic growth, income inequality, Gini index, panel data, inverted-U Kuznets curve**

I. Introduction

The studies concerning the relationship between income inequality and economic growth had been conducted over the last half century. Economic growth is the increase in the amount of production of goods and services in an economy over a certain period of time. Economic growth can be measured through the real gross domestic product (real GDP) or real per capita gross domestic product (real per capita GDP). Income inequality is measured by Gini index. The higher the value of Gini index means the higher in income inequality or the larger of the gap between the rich and the poor. Both variables are believed to be related since higher income inequality is often found in lower developed countries. Most studies focused in a one-way regression, i.e. either to study the impact of growth on income inequality or the impact of income inequality on growth.

In this paper, we seek to investigate the relationship using two-way approach. The study is focused on three groups of income levels, i.e. lower middle, upper middle and high income groups. Apart from this, we also seek to reveal the factors that determine the relationship of income inequality and growth. Applying a panel data approach, our results only detect one-way relationship, i.e. growth influences income inequality. We fail to detect significance impact from income inequality on growth across 3 groups of countries. Enrollments of primary education, price level of investment and trade openness have no significance impact on income inequality. These factors have impacts on growth but the impacts vary across countries.

Manuscript received August 1, 2013; revised December 12, 2013

II. Literature Review

A. The Measurement of Income Inequality

Lorenz curve and Gini coefficient are two ways of measurements commonly used to measure income inequality. As in [1] Lorenz curve shows the relationship between percentage of population and the percentage of total income the population received. The horizontal axis represents the percentage of population. The vertical axis shows the percentage of total income that received by the percentage of population considered. Both of the variables on the horizontal axis and vertical axis must be ordered from the lowest to the highest.

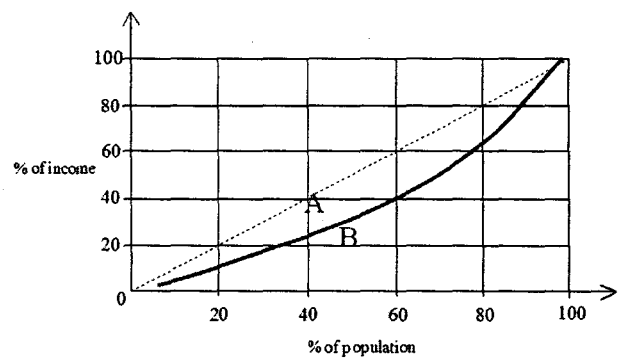

Figure 1. Lorenz curve.

As shown in Fig. 1, the dashed line represents a perfectly equal income distribution in an economy and it implies that every person in the population has the same income. By contrast, the horizontal axes and the vertical axes, which are the lines of perfect inequality, represent a perfectly unequal income distribution in an economy. In this case, only one person has all the income and all others have none. The inequality of the income distribution is shown by the distance of the Lorenz curve from the line of perfect equality. The inequality becomes higher if the Lorenz curve bends further away from the line of perfect equality (45 degree line) as in [2].

Gini coefficient is a measurement of income inequality based on Lorenz curve, which ranges between 0 and 1. Gini coefficient with 0 represents perfect income equality

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Journal paper

An Examination on the Determinants of Inflation

Yen Chee Lim and Siok Kun Sek, *Member, IEDRC*

***Abstract*—This paper examines factors affecting inflation in two groups of countries (high inflation group and low inflation group) using annual data from 1970 to 2011. An Error Correction Model based on the Autoregressive Distributed Lag (ARDL) modeling has been used to explain the short run and long run impacts of each variable on inflation. The results respectively indicate that GDP growth and imports of goods and services have the significant long run impact on inflation in low inflation countries. Results also indicate that money supply, national expenditure and GDP growth are the determinants of inflation which impose long run impact on inflation in high inflation countries. In the short run likewise, none of the variables is found to be significant determinants in high inflation countries. However money supply, imports of goods and services and GDP growth has significant relationship with inflation in low inflation countries.**

***Index Terms*—About ARDL model, dynamic panel data, GDP growth, inflation, long-run coefficient.**

I. Introduction

Inflation is a monetary phenomenon and the persistent inflation has widely attracted the attention of the economists all over the world. In common, inflation is defined to be a continuous and persistent rise in the general price level and hence leads to a fall in purchasing power. According to [1], inflation is the one form if taxation that can be imposed without legislation. Generally, inflation has been defined either as monetary phenomenon (for example, [2]) or phenomenon of raising prices (for example [3]-[5]).

There is a general agreement amongst economist that economic inflation may be cause by either an increase in the money supply or a decrease in the quantity of goods being supply. Basically, there are four types of inflation as creeping inflation, walking inflation, running inflation and jumping or hyper-inflation. Economists conclude that creeping inflation is a mild inflation which is not dangerous to the economy and is an important instrument of economic development. Walking inflation occurs when prices rise moderately and the annual inflation rate is a single digit. While running inflation refers to the annual inflation rate is double digits and treated as a signal for hyper-inflation. When the price rises to running inflation, it will affect the deprived and middle classes unfavorable.

Hyper-inflation is the prices rise very rapidly and a condition when the rate of inflation becomes immeasurable and completely uncontrollable. Hyper-inflation occurring when the country imposing it is in desperate need of money.

High inflation and fluctuation in prices is not preferred as it will cause to uncertainty and cost push shock which will affect the stability and performance of economics. Therefore, low inflation and stability in prices is always one of the core objectives targeted by the policymaker in designing the monetary policy.

The study on the determinants of inflation is important as the results will provide higher understanding on the transmission of shocks and the inter-relationship between inflation and economic factors. Hence earlier actions can be taken to avoid high inflation and the negative effects of inflation on economy. There are a lot of studies investigating the causes of the inflation and the findings are many and varied. In this study, we seek to identify the causes of inflation between two groups of countries, i.e. high and low inflation countries. The ARDL model is applied to reveal the short run impact and long run impact of each factor on inflation. Applying the dynamic panel approach, our results reveal that GDP growth and imports of goods and services have significant long run impact on inflation in low inflation countries. Money supply, national expenditure and GDP growth on the other hand, have significant long run impacts on inflation in high inflation countries. These variables have limited short run impacts on inflation.

The remaining paper is organized as follows: section 2 provides discussion on literature review, section 3 explains the data and methodology applied, section 4 summarizes the main findings and section 5 concludes and finalized the paper.

II. Literature Review

There are several empirical studies undertaken to identify the possible determinants of inflation based on different techniques and time period. Although the topic is no more new, there are continuing studies on this topic to reveal the possible factors affecting the movement of inflation. These studies report different results.

The variables that have been repeatedly taken by researchers to explain inflation are money supply, exchange rate, interest rate, inflation expectation, imported inflation and Gross Domestic product (GDP). For instance, [6]-[8] discussed that the money supply is a significant determinant of inflation. However [9] and [10] found that there is no evidence to show money supply affect in inflation.[7]-[9], [11], [12] also reported that exchange rate contributed to the rise in inflation but [13] in her study of determinant of inflation in Ethiopia found that exchange rate has a negative and insignificant impact. Nominal interest rate has positive pressure on inflation as discussed by [8], [11] and [14].

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Proceedings

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Investigating The Convergence of Growth: A Comparative Study

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Abstract. We conduct empirical investigation on the convergence of output growth in two groups of economies, i.e. European versus Asian economies. Two notions of convergence are included in our analysis, namely absolute beta convergence and conditional beta convergence. Single equation and panel data analysis techniques are applied. The results show evidences of absolute convergence using Theil approach. However, these two groups of economies fail to catch up to the growth level of U.K. either conditional or not conditional to a list of control factors.

Keywords: Catch-Up Effects; Convergence of Growth; Panel Data Analysis

1. Introduction

The rapid growth of Asia in the last three decades was an economic myth or miracle as documented by many researchers and economists. However, a regional financial crisis has changed the course of Asia's emergence. Nevertheless, the region remains dynamic and still features many of the policies that were responsible for this high growth in the past after the recovering. Not unexpectedly, Asia's strong growth performance unleashed a major debate about the factor inputs that were responsible for this high growth. The general point was that factor inputs of labor and capital. In this research, several questions emerged: does the economic growth in East–Asia can catch up with the growth level in the leading Asia country like U.K.? Are the growth supported by human investment and higher productivity? As a result, in this study, we would like to investigate the conditional and absolute convergence of growth in Europe and Asian countries.

A number of studies in the previous literature of development economics indicate that exports play an important role in economic growth in East Asian countries, [1]. Many studies also report that human capital and productivity are the main contributor to growth. According to [2], investment in human and technological capital is an important role in a growth process. Applying panel data analysis, [3] reports that human capital investment and education can have significant impact on growth in East Asian countries. He suggests that education can be a long-run policy tool used to achieve sustainable growths in a country. As concluded by [4], advanced Asian countries have the ability to reduce the income gap with US faster. Higher educated countries tend to learn and adapt new technology faster and easier compare to those lower educated countries However according to [14], the interaction effects between schooling and R&D were not significant determinants of country labor productivity growth. Apart from this, some studies report that capital and productivity are important determinant of growth, e.g. [5] and [6].

In this paper, we focus our study on investigating the convergence of growth in Europe and Asian economies. The main purposes of this study are to investigate the three types of convergence in growth of these two groups of countries, i.e. absolute β convergence and conditional β convergence. With two different models applied (Theil's inequality and Panel data analysis) we obtain results showing that absolute convergence exists for both the Europe and Asian regions, but this convergence does not hold in the selected Europe and Asian countries when panel data analysis is being used.

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Proceedings

Investigating the Relationship between Inflation and Growth: Evidence From Panel ARDL Models

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Abstract. The study of the relationship between inflation and growth is important as it provides crucial information for policy decisions. In this study, we seek to investigate the short-run and long-run relationship between inflation and growth in 3 groups of countries: high income, low income and middle income groups using the Auto Regression Distributed Lag models. The MG (Mean Group) and PMG (Pooled Mean Group) estimations are applied in this analysis. The Hausman Test is conducted to decide between the MG and PMG estimators. The panel data take the period of 1960-2012. As the result, MG estimator is preferred by all the 3 groups of countries. The results provide the dynamic relationships (short-run and the long-run relationships) between the three variables tested. The highly significant error correction term in the low income and middle income group further confirms the existence of a stable long-run relationship. The long-run relationship exists in the high income group but it is not significant. Comparisons of the results across the three groups of countries have revealed deeper information on the relationship across different income levels.

Keywords: Inflation, growth, panel data.
PACS: 88.05.Lg

INTRODUCTION

The relationship between inflation and growth has gained attention to academic researchers and market practitioners as well as the policy makers. Although many theoretical links between inflation and growth has been extensively discussed for centuries, a lot of controversies still abound concerning their actual effects [1]. Many theoretical studies have contributed to the relationship between inflation and growth, as in the succinct summary in [2], the impact regarding inflation on growth are categorised into four group: (i) [3]: Inflation has no effect on growth; (b) [4]: money is a substitute for capital, causing inflation to have a positive effect on long-run growth; (c) [5] :money is complementary to capital, causing inflation to have a negative effect on long-run growth; and (d) [6] and [7]: Inflation has a negative effect on long-run growth, if the inflation rate exceeds the certain threshold level.

As the theoretical study, it is likewise as the inconclusive nature of empirical evidence, where a lot of controversies still abound. For instance, in the study of [2], inflation has a negative effect on growth, but only after inflation reaches a threshold level. [8] found a significant negative relationship between inflation and growth. In the study of [7], there are 140 industrial countries and non-industrial countries. Their study responses the doubt of the former US Fed Governor, Ferguson doubt whether the pace of economic development is slower when inflation is at 15 percent than when it is at 5 percent [9]. They concluded that the lower inflation is better on promoting the economic growth. The negative and significant relationship exists between inflation and growth at the threshold level. Furthermore, a positive association between inflation and growth is found in the study on South Asian countries [10]. Besides, they also noted that the sensitivity of inflation to changes in growth rate is larger than that of growth to change in the inflation rate. In [11], on the study of the US economy, they found a positive association between inflation and growth during the 1980s accompanied by a downward trend in inflation.

On the other hand, the study of causal relationship within 70 countries by [12], they concluded that there was no causal relationship between inflation and growth. [13], [14] and [15] claimed that there is no significant evidence that inflation variability is detrimental to growth in the developed countries. In the study of [16] also drew the same conclusion as the studies of [14] and [15].

As mentioned in the previous theoretical and empirical studies on the inflation and economic growth, the importance of inflation on economic growth has awakened interest over the years to both policy makers and economists. Thus, this paper sought to investigate the short-run and long-run relationship between inflation and growth to ascertain consensus on the inflation-growth relationship. Then, the MG (Mean Group) and PMG (Pooled Mean Group) estimations are applied in this analysis. Lastly, the Hausman Test is conducted to decide between the MG and PMG estimators. The results have provided the dynamic relationships (short-run and the long-run

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AIP Conf. Proc. 1605, 943-948 (2014); doi: 10.1063/1.4887717